Zoning the forest

A successful approach to zoning Guyana's Iwokrama Forest for conservation and sustainable use offers a model for integrating a wide range of forest-based values in land-use allocation processes

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Talking shop: consultations with local and national stakeholders on zoning scenarios helped increase the chance that the final recommended locations would be acceptable to all parties. *Photo: D. Hammond*

IN 1996, the Government of Guyana passed national legislation (the Iwokrama Act) establishing the Iwokrama International Centre (IIC) for forest research and development and giving it responsibility for the management of the Iwokrama Forest, a 370 000-hectare forest area in the heart of Guyana. The Centre's major goal is to demonstrate that tropical forests can be conserved while generating income through sustainable and equitable use.

The Act required the division of the Iwokrama Forest into two zones of roughly equivalent size: a 'Wilderness Preserve' and a 'Sustainable Utilisation Area'. This would ensure that large areas of relatively unmodified landscapes could be managed towards an objective of conserving nature and natural processes, while adjacent areas could be managed sustainably to produce goods and services for the benefit of local and national communities and the IIC.

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By necessity, the zoning process was embarked upon despite a paucity of knowledge about the forest. But while management plans can be revised and modified with relative ease to accommodate new information and changes in socio-economic or cultural circumstances, rezoning is much more difficult. For example, designation of the Wilderness Preserve as an IUCN Category 1b Strict Nature Reserve or even a World Heritage site would complicate any decision to change the boundaries of the two zones at a later stage. The task of the IIC team, then, was to develop a process for zoning that would stand the test of time.

Forest values

The Iwokrama Forest is home to healthy populations of some of the most endangered species of forest fauna in the neotropics and some valuable timber and non-timber forest products. It is located at an important juncture between Amazonian and Guianan floristic provinces and possesses a unique blend of elements from eastern Amazonia and the Guianas.

The area has a long history of traditional use and spiritual beliefs linked to the local Makushi and Patamona peoples. Early last century it was also one of the most active centres in the large-scale production of balata, the coagulated latex from the tree *Manilkara bidentata* (bulletwood). More recently, a local and national debate has arisen over who should benefit from forest resource uses such as commercial mining and timber harvesting, hunting, fishing, wildlife collection and ecotourism and in what form such uses should be allowed. Thus, many people have 'stakes' in the management of the area, including local Amerindians, scientists based at the IIC, business operators, those involved in the commercial extraction of resources, the national government, and others.

Decision-making framework

Such stakeholders value the Iwokrama Forest for many reasons. Some values are held in common but others are not so widely accepted. Conflict and stalemate can rapidly undermine the success of land-use zoning if these values are discounted and subsequently not integrated into the decision-making process in a transparent and fair manner.

Thus, IIC staff formulated a zoning process that had several components. These included the development of

a framework of principles and criteria, data-gathering, the construction of a decision-support system, and wide stakeholder participation.

Principles and criteria

The principles and criteria approach was inspired by the well-established sets of principles, criteria and indicators for evaluating progress towards sustainable forest management developed by ITTO and the Centre for International Forestry Research (CIFOR) and through the (South American) Tarapoto Process *(Table 1)*. Each principle was considered as a unique goal or desirable outcome of the zoning process. Decision-making criteria were, in effect, forest-based values (in many cases, direct uses) that could contribute to achieving the goal established under each principle.

A set of draft principles and criteria for decision-making was developed through a process involving local community residents, national agency staff and representatives of non-governmental organisations. Each criterion was then evaluated against: 1) the overarching objective assigned to each zone; 2) the allowable uses assigned to each zone; and 3) whether its inclusion would influence the decision-making process.

Several criteria, such as traditional subsistence hunting or plant collecting, were not considered to influence zoning because these use rights are protected under the Iwokrama Act and are permitted in all parts of the Iwokrama Forest. It was decided that the protection of hunting and collecting rights in areas where relatively intensive activities such as selective timber harvesting may be carried out would be better addressed in later participatory management planning processes. Other criteria, mainly associated with the conversion of forest to other land-uses, were incorporated in the broader framework but were not included in the decision-making process because these were incompatible with the overarching management objectives set for the Iwokrama Forest. For more details of the principles and criteria selection process see Hammond and Hughell (2001).

Characterising criteria

A framework of principles and criteria helped give a structure to the main resource use issues that would be affected by zoning. However, to establish a link between the framework, the forest and the people that use the forest, an information database was needed. This was constructed through a combination of rural resource appraisals and workshops, oral and written local and scientific knowledge related to the biology and use of Guyana's forests, targeted resource surveys of the Iwokrama Forest, including a strategic inventory of key plant species (assisted by the use of global positioning systems), and geographical information derived from topographic maps and remotely-sensed imagery. A geographic information system (GIS) was used to store, process and map all the spatial information to be used in the zoning process. Nonetheless, the resulting

A matter of principles

Table 1: A global set of principles and criteria for decision-making and the working set (in bold) adopted for use in the Iwokrama Forest zoning process. Criteria represent benefits associated with an area being included in the Wilderness Preserve (dark shading) or the Sustainable Utilisation Area (light shading)

Principle		Criteria
1. Conservation of traditional uses of Iwokrama Forest by Amerindian communities	1.1	Integrity and accessibility of plant collection sites ensured
	1.2	Integrity and accessibility of traditional hunting and fishing grounds ensured
	1.3	**Access to subsistence use areas for traditional agriculture ensured**
	1.4	**Integrity and accessibility of sites of cultural or spiritual significance ensured**
2. Conservation of Iwokrama's natural resources	**2.1**	**Natural forest types protected**
	2.2	**Aquatic habitats conserved**
	2.3	Soil resources conserved
3. Optimisation of benefits from the sustainable commercial extraction of Iwokrama's natural resources	**3.1**	**Contribution to timber production potential**
	3.2	**Contribution to non-timber plant product potential**
	3.3	**Contribution to sustainable wildlife harvesting potential**
	3.4	**Contribution to mineral extraction potential**
4. Optimisation of benefits from conversion of the Iwokrama Forest for long-term, non-forest land-uses	4.1	Permanent agricultural production maximised
	4.2	Permanent livestock production maximised
	4.3	Permanent plantation forest production maximised
5. Optimisation of benefits from the sustainable, commercial, non-extractive utilisation of the Iwokrama Forest	**5.1**	**Ecotourism support potential maximised**
	5.2	Paid scientific research/education maximised
	5.3	Carbon sequestration/offset potential maximised
	5.4	Hydropower generation potential maximised
	5.5	Wind power generation potential maximised
	5.6	Endowment potential maximised
6. Protection of Iwokrama's cultural heritage	**6.1**	**Archaeological/historical sites protected**
7. Accounting for the effects of long-term climate change on forest benefits and management objectives	**7.1**	**Likelihood of forest fire events reduced**
	7.2	**Impacts of shifting environmental conditions along altitudinal gradients**
8. Efficient and effective management of Iwokrama Forest	**8.1**	**Administrative, recreational, research and educational infrastructure developed and maintained**

Benefit mapping

Figure 1: the region was divided into a patchwork of catchment units (**1a**), and areas of particular cultural or spiritual significance (**1b**), timber potential (**1c**) and habitat diversity (**1d**) were identified and mapped

1a. Catchment units

1b. Cultural and spiritual areas

1c. Timber benefits

1d. Habitat diversity

database contained sparse information in many key areas, particularly regarding the biological components.

The spatial distribution of benefits

The next step was to 'divide' the Iwokrama Forest into a patchwork of small catchments on 1:50 000 national topographic maps *(Figure 1a)*. Using the smallest category of 'stream' contained in the database, this process produced a set of 930 catchments ranging in size from 35 to 5 600 hectares. These catchments became the basic land units in the decision-making process.

The land units were then assigned values derived from the map-based information *(figures 1b–1d)*. In some cases, the values were generated from simple relationships between a unit's known biophysical attributes and the extent to which the unit might contribute to the outcome stated in the targeted criterion relative to other areas in the Iwokrama Forest. In the case of the criterion concerned with timber production, for example, the spatial distribution of benefit was estimated through a simplified relationship linking the stocking densities of harvestable-sized individuals (>40 cm dbh) of 22 commercial timber species assigned according to forest type, the median slope of each catchment, a distance 'damper' based on the distance of the catchment to the nearest large river or road (ie the greater the distance, the lower the timber 'value'), and other damper functions that integrated regeneration and conservation considerations.

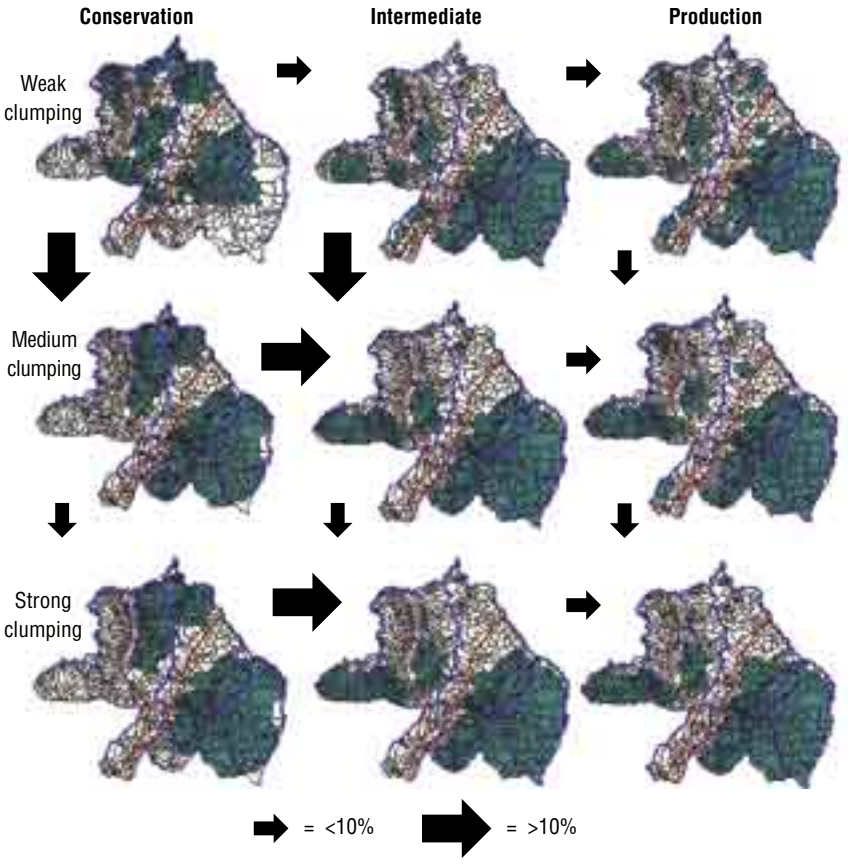
For each land unit, scores were assigned for each potential benefit relative to the benefit attached to all other catchments. These scores were then standardised so that the spread of values assigned across the catchments always fell between 0 (lowest) and 1 (highest relative benefit) for each of the criteria; the distribution of these scores could then be mapped. The weighted sum of benefit scores for each catchment could be calculated according to criteria sets supporting inclusion into either the Wilderness Preserve or the Sustainable Utilisation Area. The net difference between these two sums provided a first indication of the benefit of assigning a given catchment to one or other of the zones.

Decision-support model

Estimating the benefit of allocating each catchment for protection or sustainable use based on standardised scores alone would assume that all criteria were equally important to stakeholders and that management perspectives and priorities were adequately incorporated through the benefit-assigning process. However, it was clear that the available data for decision-making varied in accuracy and completeness. Moreover, considerations outside the framework of principles and criteria had to be taken into account; for example, legal requirements governing the relative allocation of forest to each zone had to be met and the longer-term plans and allowable uses for each zone had to be cross-checked with existing known impacts of land-uses that pre-dated the demarcation of the Iwokrama Forest. Many such areas were sufficiently degraded such that their inclusion in the Wilderness Preserve would preclude future plans to seek international recognition of it as a world-class conservation reserve.

The matrix

Figure 2: Nine-scenario matrix presented to the national stakeholder working groups. Scenarios reflect variation in the management objectives and degree of clumping required among catchment units contributing to the Wilderness Preserve zone. Arrow size represents the percent change in catchment area allocated between the two zones



In the zone

Figure 3: the final agreed zoning for the Sustainable Utilization Area and Wilderness Preserve, Iwokrama Forest

To accommodate some of these issues, a decision-support model was developed to integrate benefits generated through the principles and criteria framework and rules applied to meet requirements of governing legislation and future plans. Limits on the area that could be allocated to each zone were applied in the model. Catchments affected by road construction, small-scale mining, agricultural clearance and other forms of infrastructure development that were not factored into the principles and criteria framework were 'forced' into the Sustainable Utilisation Area.

The effect of varying the allowable level of 'dispersion' of the Wilderness Preserve across the Iwokrama Forest was also taken into account. The model applied linear programming to allocate catchments under different 'rules' and develop scenarios that optimised the distribution of benefits between the two zones: each scenario reflected the weights applied to each of the criteria and the rules-based limits applied to assigning certain catchments to a particular zone and the total area that could be allocated to each zone.

Reaching an agreeable outcome

Deciding the two zones based purely on the results of the optimisation model, which itself was based on often sparse information, would all but guarantee that the final outcome would be disagreeable to one or more of the key groups of stakeholders. A series of workshops with stakeholders to review the principles and criteria framework and zoning options, focal group sessions and local community visits helped to increase understanding of the zoning process while also affording an opportunity to incorporate additional knowledge and perspectives. Articles in newspapers, newsletters and magazines also broadened the base of exposure and understanding.

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GIS-generated maps illustrating the effects of varying rules and weightings proved to be crucial in bridging the technological gap between different stakeholders. They allowed stakeholders to view all the available information on the forest and to see the effects of applying different rules to land-use allocation *(Figure 2)*. Stakeholders were able to explore the way in which the location of the two zones changed when criteria for conservation and production were weighted differently, and to identify options that were most consistent with their group's priorities and perspectives.

The final proposed zoning *(Figure 3)* was submitted to the key stakeholder group representatives for final comments prior to submission to the Iwokrama Board of Trustees, which approved the proposal at a meeting in June 2001. IIC staff and partners are now moving forward with developing management plans for each zone.

Lessons learned

The situation in the Iwokrama Forest is not unique. How to accommodate the manifold needs and desires of diverse stakeholders is exercising minds in many other forests, both in and beyond the tropics. The approach adopted by IIC in its efforts to achieve a mutually agreeable outcome for the zonation of the Iwokrama Forest hinged on a combination of local and scientific knowledge, targeted and broad-based survey work, and a transparent and honest effort to review and incorporate the recommendations and priorities of local and national stakeholders in the final land-use allocation. Documenting the outcome of each phase of the zoning process and providing periodic feedback was crucial in developing a broader sense of ownership and a basic understanding of the purpose and process among key local stakeholder groups.

A practical step-by-step guide to developing similar approaches for supporting forest land-use allocation is being developed by IIC staff and institutional partners, in part through ITTO PROJECT PD 10/97 REV. 1 (F). The guide is intended to assist in situations where decision-making processes could benefit from greater integration of local and scientific knowledge, field surveys, GIS technology and, importantly, stakeholder participation at each crucial point along the decision-making path.

Reference

Hammond, D. & Hughell D. (eds.) 2001. *Zoning the Iwokrama Forest.* Iwokrama International Centre, Georgetown, Guyana. (available at www.iwokrama.org)

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